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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/825,394	04/14/2004	Vishwas V. Hardikar	004.0128	8468

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EXAMINER	
GEORGE, PATRICIA ANN	
ART UNIT	PAPER NUMBER
1765	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/07/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/825,394	HARDIKAR, VISHWAS V.	
	Examiner	Art Unit	
	Patricia A. George	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 December 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-43* is/are pending in the application.

4a) Of the above claim(s) *1-35* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *36-43* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.
>
> This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 36 rejected under 35 U.S.C. 102(a) as being unpatentable over Patel et al. (2003/0171239) (herein referred to as Patel), in view of Burton (6,083,838), evidenced by University of Florida (http://www.cop.ufl.edu/safezone/prokai/pha5100/Eagents.htm) (herein refered to as UFL) and Princeton Environmental Institute (Chelation, uptake, and intracellular binding of trace metals; http://www.princeton.edu/~cebic/chelbindadvanced.html).

Patel et al. teach methods of processing wafers, include: CMP by slurry (i.e. polishing a wafer with slurry having a pH and ionic strength) (see para. 9); after the CMP a step of CMP wetting (para. 64 and figure 4), wherein the composition comprising non-ionic surfactant (i.e. wetting agent) (paragraph. 0047). Patel teaches wt% of non-ionic surfactant 0.6 – 5 wt %, which is encompassed by applicants' claimed range of 0.005-10 wt % (see Table 1). Patel inherently teaches wetting agent (i.e. non-

ionic surfactant) with HBL value of 7-9 (evidenced by ULF, teaching HLB levels of surfactants, including wetting agents at 7-9 HLB) encompassed by applicants claimed range of 1-15). Patel teaches the composition has corrosive inhibitors and chelating agents, well known to have the inherent property of complexing with trace metal impurities and Cu (see 0041, evidenced by Princeton Environmental Institute). Patel teach the composition is particularily good for cleaning CMP copper substrates (see 0105). Patel et al. teaches pH adjusters (see para. 0110).

As to applicants' limitation a non-ionic surfactant comprising block copolymers of ethylene oxide and propylene oxide, Burton et al. teaches by adding propylene oxide-ethylene oxide block copolymers perfered surfactants to the slurry, once added, the viscosity of the slurry increases and surfactant micelles form in the slurry, encapsulating the oxidant. The surfactant encapsulates the oxidant, thus inhibiting the oxidants ability to oxidize the underlying layer. For a higher oxidation rate, less surfactant may be added to allow more free unencapsulated oxidant to react with the semiconductor wafer(see col.4, line 64 through col. 5, line 10. Such control of the oxidation in the CMP process is benificial because one can minimizes the oxidation and resulting oxide erosion that occurs during a CMP Process (see last sentance of Background), a a direct effect on the polishing rate, a known process improvement.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to modify the invention methods CMP by slurry, as Patel et al., to include the non-ionic surfactant comprising block copolymers of ethylene oxide and propylene oxide, as Burton et al., because Burton et al. teaches such surfactants

benefit CMP slurry methods by inhibiting the oxidants ability to oxidize the underlying layers, which minimizes the resulting oxide erosion.

Claim Rejections - 35 USC § 103

Claims 37 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Patel et al. and Burton, as applied to claim 36 above, further in view of Cooper et al. (Comparing the effectiveness of knobby and ridged post-CMP cleaning brushes; Micron Technology; July 19999; Micromagazine; archive; www.micromagazine.com, page 1 of 9).

Although, Patel et al. teaches wetting compositions to the wafer surface for precision CMP, post-clean, and post-cmp rinsing (para. 26-29), Patel does not teach the composition is sprayed or brushed on, or that loading occurs via a load cup as in claims 37-39.

Cooper et al. teaches methods for post cmp clean utilizes rotating foam brushes while sprayed, as in claims 37, and 39, to remove excess metal and slurry particles, to avoid adverse effects in downstream processing (see page 1 of 9).

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to modify the invention of applying the CMP post clean composition of Patel et al, by incorporating the use of utilizes rotating foam brushes while sprayed, as in claims 37, and 39, because Cooper teaches the process removes excess metal and slurry particles, to avoid adverse effects in downstream processing.

Claim Rejections - 35 USC § 103

Claim 38 is rejected under 35 U.S.C. 103(a) as being unpatentable over Patel et al., Burton et al, and Cooper et al., as applied to claims 37 and 39 above, further in view of Karlsrud et al. (5,329,732).

As to claim 38, the modified teaching of Patel et al. is silent as to the delivery methods implored to transfer the wafer to the post clean station, such as loading the wafer into a load cup, as applicants' limitation of claim 38.

Karlsrud et al. illustrates a well known method implored to transfer the wafer to the post clean station, loading the wafer into a load cup, as applicants' limitation of claim 38 (see col. 11-12, lines 45-17).

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to modify the invention of Patel et al., to include the a well known method implored to transfer the wafer to the post clean station, loading the wafer into a load cup, as applicants' limitation of claim 38, because Karlsrud et al. illustrates it is a well known method.

Claim Rejections - 35 USC § 103

Claim 40 is rejected under 35 U.S.C. 103(a) as being unpatentable by Patel et al. (2003/0171239) (herein referred to as Patel), in view of Burton et al. (6,083,838), Misra (7,087,564), and Kern (Editor of Handbook of Semiconductor Wafer Cleaning Technology - Science, Technology, and Applications; William Andrew Publishing/Noyes; ISBN: 0-8155-1331-3; Mar 21, 2001)

Patel et al. teach methods of processing wafers, include: CMP by slurry (i.e. polishing a wafer with slurry having a pH and ionic strength) (see para. 9); after the CMP a step of CMP wetting (para. 64 and figure 4). Patel teaches the composition has corrosive inhibitors (see para. 0041) Patel teach the composition is particularily good for cleaning CMP copper substrates (see 0105). Patel et al. teaches pH adjusters (see para. 0110).

Although Patel teaches pH adjustment, Patel is silent as to the wetting composition within 1 (plus or minus) pH of the CMP slurry pH, as in claim 40.

Mirsa teaches to match the pH of the wetting (i.e. cleaning) solution to that of the last slurry used on the wafer surface (see abstract of 7,087,564), i.e. matching withing applicants' claimed limitation within 1 (plus or minus) pH of the CMP slurry pH, as in claim 40.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to include matching the pH of the wetting and slurry compositions, as Misra, when performing the copper processing, as Patel, because Misra teaches an improvement which removes particles efficiently, removes metal from the dielectric surface, protects the metal from corrosion and dissolution, and does not contaminate the semi conductor surface (see ab. of 7,087,564).

Patel is silent as to the ionic strength of the composition as in applicants' limitation of claim 40.

Although Patel is silent as to the ionic strength of the composition as in applicants' limitation of claim 40, it would have been obvious to one of ordinary skill in the art at the time of invention was made, to include the ionic strength as applicants' claim limitation, when using the methods that including a CMP wetting composition, as the modified invention of Patel, because it has been help that products of identical composition can not have mutually exclusive properties (see MPEP 2112.01).

Patel is silent as to the ionic strength of the composition as in applicants' limitation of claim 40.

Kern teaches that the pH of a composition, and colloidal potential are relative to the ionic strength of the wafer cleaning composition (see pages 180-183), and illustrates that ionic strength is a properties of a wafer cleaning composition that may be controlled or adjusted for a desired effect within a range of 10^{-5} to 10^{-1} mol/liter, which encompass applicants claimed range of 10^{-5} to 10^{-2} mol/dm3 (mol/dm3 = mol/liter) (see page 184).

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to include applicants' claimed range of ionic strength, when using a cleaning composition to clean wafers, as Patel, because Kern illustrates such a range is effective and may be controlled for a desired effect colloidal deposition which impacts electrostatic double layer repulsion, that impacts interacting diffuse layers of a colloid and a wafer surface, i.e. resulting in controlling the removal of contaminates, a known process improvement (See pages 180-184). Also, since Patel does not limit

the ionic strength, one of ordinary skill would select any ionic strength within the range of Kern, including applicants' specifically claimed range. Furthermore, in absence of unexspected results one of ordinary skill in the art would be motivated to use any ionic strength within the range of Kern, for cleaning wafers, including the range disclosed by applicants.

As to applicants' limitation a non-ionic surfactant comprising block copolymers of ethylene oxide and propylene oxide, Burton et al. teaches by adding propylene oxide-ethylene oxide block copolymers perfered surfactants to the slurry, once added, the viscosity of the slurry increases and surfactant micelles form in the slurry, encapsulating the oxidant. The surfactant encapsulates the oxidant, thus inhibiting the oxidants ability to oxidize the underlying layer. For a higher oxidation rate, less surfactant may be added to allow more free unencapsulated oxidant to react with the semiconductor wafer(see col.4, line 64 through col. 5, line 10. Such control of the oxidation in the CMP process is benificial because one can minimizes the oxidation and resulting oxide erosion that occurs during a CMP Process (see last sentance of Background), a a direct effect on the polishing rate, a known process improvement.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to modify the invention methods CMP by slurry, as Patel et al., to include the non-ionic surfactant comprising block copolymers of ethylene oxide and propylene oxide, as Burton et al., because Burton et al. teaches such surfactants

benefit CMP slurry methods by inhibiting the oxidants ability to oxidize the underlying layers, which minimizes the resulting oxide erosion.

Claim Rejections - 35 USC § 103

Claims 41 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Patel, Misra, and Kern, as applied to claim 40 above, in view of Cooper et al. (Comparing the effectiveness of knobby and ridged post-CMP cleaning brushes; Micron Technology; July 19999; Micromagazine; archive; www.micromagazine.com, page 1 of 9).

Although, Patel et al. teaches wetting compositions to the wafer surface for precision CMP, post-clean, and post-cmp rinsing (para. 26-29), Patel does not teach the composition is sprayed or brushed on, or that loading occurs via a load cup as in claims 41 and 43.

Cooper et al. teaches methods for post cmp clean utilizes rotating foam brushes while sprayed, as in claims 41, and 43, to remove excess metal and slurry particles, to avoid adverse effects in downstream processing (see page 1 of 9).

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to modify the invention of applying the CMP post clean composition of Patel et al, by incorporating the use of utilizes rotating foam brushes while sprayed, as in claims 41, and 43, because Cooper teaches the process removes excess metal and slurry particles, to avoid adverse effects in downstream processing.

Claim Rejections - 35 USC § 103

Claim 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over Patel, Misra, Cooper, and Kern, as applied to claims 41 and 43 above, further in view of Karlsrud et al. (5,329,732).

As to claim 42, the modified teaching of Patel et al. is silent as to the delivery methods implored to transfer the wafer to the post clean station, such as loading the wafer into a load cup, as applicants' limitation of claim 42.

Karlsrud et al. illustrates a well known method implored to transfer the wafer to the post clean station, loading the wafer into a load cup, as applicants' limitation of claim 38 (see col. 11-12, lines 45-17).

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to modify the invention of Patel et al., to include the a well known method implored to transfer the wafer to the post clean station, loading the wafer into a load cup, as applicants' limitation of claim 42, because Karlsrud et al. illustrates it is a well known method.

Response to Arguments

Applicant's arguments, on pages 9-12, are all toward the amendments, of 12/29/2006, not addressed in the rejection of 10/02/2006, examiner agree. Please see new grounds of rejection above.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patricia A. George whose telephone number is (571)272-5955. The examiner can normally be reached on weekdays between 7:00am and 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571)272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Patricia A George
Examiner
Art Unit 1765

PAG
09/06

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER